THE MONROE INSTITUTE'S HEMISYNC PROCESS

Hemisync is a patented auditory guidance system which is said to employ the use of sound pulses to induce a frequency following response (FFR) in the human brain. It is reported that the Hemisync process can heighten selected awareness and performance while creating a relaxed state. Hemisync is more than this however, and an extensive evaluation is warranted. Hemisync involves the physics of resonant entrainment, brain waves and their relationship to the behavioral psychology of consciousness, and the physiology of the brain.

The Physics of Entrainment:

Resonant entrainment of oscillating systems is a well understood principle within the physical sciences. If a tuning fork designed to produce a frequency of 440hz is struck, causing it to oscillate, and then brought into the vicinity of another 440hz tuning fork the second tuning fork will begin to oscillate. The first tuning fork is said to have entrained the second or caused it to resonate. There are three basic rules of the physics of entrainment. Resonate rule: For one oscillating system to be capable of entraining another the second system must be capable of achieving the same vibratory rate (oscillating frequency). An oscillating 440hz tuning fork will not entrain a 300hz tuning fork because the second tuning fork will not vibrate at 440hz. The second basic rule involves power. Power rule:

For one oscillating system to be capable of entraining another the first must have sufficient power to overcome the homeostasis of the second. In the case of the tuning fork example, the first must be brought in close proximity to the second since the effective radiated power of the first diminishes with distance. The third rule involves consistency. Consistency rule: For one oscillating system to be capable of entraining another the first must be at a constant or fixed frequency. The tuning fork is an ideal example because it produces an oscillation of constant frequency and amplitude. This ideal condition is called a standing wave.

The physics of entrainment apply to biosystems as well. What is of concern here are the electromagnetic properties called brain waves. The electrochemical activity of the brain results in the production of electromagnetic wave forms (brain waves) which can be objectively measured with sensitive equipment. Brain waves change frequencies based on neural activity within the brain. Because neural activity is electrochemical, brain function can be externally modified through the introduction of specific chemicals (mind altering drugs) or by altering the brain's magnetic environment (entrainment). Caffeine, nicotine, and alcohol are mind-altering drugs, whereas sunspots and heterodyning radio and microwave frequencies are entrainment environments. Beyond these obvious things the senses of sight, touch and hearing provide for easy access to the neural functions of the brain. Each of these senses responds to wave form

activity within the surrounding environment and transmits information to the brain by means of electron pulse stimulation. The senses of taste and smell are generally not of practical use in entrainment due to their inherent low rate of pulse stimulation as well as the fact that their neural processing centers are found in lower brain centers and entrainment of these lower centers would have little effect on the rest of the brain. The senses of sight, touch and hearing by their very nature provide a fertile medium for entrainment of brain waves and, therefore, neural brain function. Manipulation of sense specific environments do in fact result in brain wave entrainment. A strobe light flashing at 10hz will entrain brain waves to that frequency.* When the brain's electromagnetic environment entrains to the 10hz, resultant psychological behaviors are evident. In a laboratory environment however, not every subject entrains to the 10hz strobe signal. To resolve this dilemma one must return to the basic rules of entrainment. For those subjects who do not entrain to the 10hz it would appear that the effective power level of the strobe signal at that frequency is insufficient given the physiological homeostasis of the subject. As in the case of the tuning forks, the electrochemical neuromas (the brain) must be capable of resonating at the desired entrainment frequency. Subjects who are displaying stable high

*Tests have been conducted using different colors of strobes. Red seems to be the most effective color. Red stimulates more neural traffic and therefore a higher level of electrical activity which in turn saturates the brain's electromagnetic environment with the strobe frequency.

amplitude brain waves at 26hz will tend to maintain homeostasis even when exposed to the 10hz strobe.

What could cause such rigid stability? The brain responds to both chemical and electrical stimulation environments. Those environments are generally controlled by life's situations as well as acts of will both conscious and subconscious. The rigid 26hz (beta) frequency may be the result of too much coffee, experiment anxiety, or the willful act of "not letting this strobe be in control." That's not to say that the subjects who do get entrained are weak-willed. They have simply made the willful decision to let themselves be entrained. Techniques have been developed to overcome resistance to brain wave entrainment. In the above case, the resistant subjects could be coached to try and relax, given a sedative to break down the physiological homeostasis, or the strobe frequency can initially be brought to within 85% of the subjects state (26hz in this example) and then slowly moved to the desired frequency (10hz in this example). By bringing the strobe frequency within 85% of the subject's state, its influential power (ability to entrain) is increased many times. If the strobe frequency were, for example, 50% of the subject's state it would not have any entrainment power and would in fact act to maintain the subject's state as it resonates the half wave (harmonic) of the subject's state. Other practices such as humming (mantras, resonate tuning), autogenic training, and/or biofeedback can also be used to break down the homeostasis of resistant subjects (Tart,1975).

The strobe entrainment effect involves only one of the sensory channels mentioned previously as being neural avenues capable of transporting entrainment signals. The kinesthetic sense of touch is another. In one interesting experiment a researcher set up a standing wave of a desired frequency in a water bed. The resultant tactile signals were effective in entraining the subject's brain waves to the selected frequency (Houck, 1984). In the case of Hemisync, the sense of hearing provides the neural avenues by which entrainment signals can be introduced into the electromagnetic cranial environment. The "frequency following response" of Hemisync is in fact the well established principle of entrainment. Sound pulses are used to entrain brain waves.

Brain Waves and the Behavioral Psychology of Consciousness:

One of the biggest criticisms of brain wave research is characterized by the popular notion that one can't tell what a person is thinking by measuring their brain wave patterns. By way of analogy this is like saying that one can't tell what information is in a computer by simply measuring voltages present at various points. There is probably some human resistance here to others to being able to "get inside one's head" and to know who one really is or what one is really thinking. A more realistic approach here would be to use a telephone as an analogy. A telephone has three "states of consciousness". State one is standby - the telephone just sits there waiting to

be used. State two is ringing - the telephone is actively soliciting attention. State three is talking - the telephone is being used. All of these "states of consciousness" of the telephone can be determined by measuring the line voltage of the telephone wires. One does not have to have direct access to the telephone itself to know what it is doing. If there are 48 volts direct current present on the wires then the phone is in state one or standby. If there are 100 volts alternating current on the wires then the telephone is in state two or ringing. When there is a modulated 10 volt direct current on the phone wires then the telephone is in state three or being used (busy). These telephone states of consciousness are discrete in that the telephone can not be in more than one state at a time. It is either waiting, ringing, or busy.

Measuring brain waves is somewhat similar to measuring telephone line voltage. When, through the measurement of line voltage, one determines the telephone is in use (state three) this does not reveal what is being said over the telephone. The same is true about brain waves. When, through the measurement of brain wave frequencies and associative patterns, it is detected that an individual is in REM sleep (dreaming) this does not reveal the dream content. This can only be discovered if the experimenter awakens the subject and asks him to describe his dream.

But brain waves are more than just indicators of discrete states of consciousness. They represent the electrochemical

environment through which perceived reality is manifest. Perceived reality changes depending on the state of consciousness of the perceiver (Tart,1975). Some states of consciousness provide limited views of reality while others provide an expanded awareness of reality. For the most part, states of consciousness change in response to immediate socio-environmental surroundings. (The psychologist would call these changes in ego states or subpersonalities.) As mentioned before, states of consciousness are subject to other influences as well. Such things as drugs and sunspots can alter states of consciousness. Additionally, all life forms appear to be subject to circadian and ultradian rhythms (Rossi, 1986).* Specific states of consciousness can also be learned as an adaptive behavior to demanding circumstances (Green and Green, 1986).

Hemisync and the Physiology of the Brain:

Hemisync's frequency following response (FFR) is applied through the use of a unique phenomena called binaural beats. Unlike the gross effect of strobe entrainment described previously, the FFR of Hemisync provides the user with access to and control of highly specific discrete states of consciousness. But before proceeding it is necessary to understand a little bit about what binaural beats are and are not.

*Ultradian rhythms are psychophysiological processes involving alternating autonomic and brain functions that have a 90 to 100 minute periodicity within the 24 hour circadian cycle.

When two signals of different frequencies are mixed together what is known in electrophysics as a heterodyne effect takes place. As a result of heterodyning a complex signal is produced which includes both original frequencies, a signal at the sum of the original frequencies, and a signal at the difference between the original frequencies. To illustrate:

> A mix of a signal of 100hz with a signal of 300hz will heterodyne into a complex wave form which, when examined contains signals at 100hz (original), 200hz (difference), 300hz (original), and 400hz (sum).

The heterodyne effect is used in radio technology to tune in various signals. In AM radio the incoming radio waves are heterodyned with an internal tuneable oscillator. The resultant difference between the two frequencies (called the beat frequency oscillation) is modulated by the sound heard coming from the radio. The heterodyne effect is a well understood principle in physics. The beat frequency oscillations which are produced by heterodyning signals are <u>not</u> the same as binaural beats. Beat frequency oscillations in the audio range are usually the result of electronically mixed (heterodyned) signals, are recordable by a second device (tape recorder, oscilloscope, etc.), and can be aurally detected with one ear. Binaural beats, on the other hand, are not the result of electronically mixed signals, are not recordable by device, and to be detected require the combined action of both ears. Binaural beats exist as a consequence of the interaction of perception within the brain (Oster, 1973).

Binaural beats were discovered in 1839 by a German

experimenter named H. W. Dove. The human ability to "hear" binaural beats appears to be the result of evolutionary adaptation. Many evolved species can detect binaural beats because of their brain structure. The frequencies at which binaural beats can be detected change depending on the size of the species' cranium. In the human, binaural beats can be detected when carrier waves are below about 1000hz (Oster, 1973). Below 1000hz the wave length of the signal is longer than the diameter of the human skull. This being so, signals below 1000hz curve around the skull by diffraction. The same effect can be observed with radio wave propagation. Lower frequency (longer wave length) radio waves (like AM radio) travel around the earth over and in between mountains and structures. Higher frequency (shorter wave length) radio waves (like FM and TV) travel in a straight line and can't curve around the earth. Mountains and structures block these high frequency signals. Because sound frequencies below 1000hz curve around the skull, incoming signals below 1000hz are heard by both ears.* But, due to the distance between the ears, the brain "hears" the inputs from the ears as out of phase with each other. As the sound wave passes around the skull each ear gets a different portion of the wave. It is this wave-form phase difference which allows for accurate

*In the case of signals above 1000hz the skull blocks the signal from the lee side ear. The source of the sound is then determined by the brain to be in the general direction of the loud noise, there being little or no noise in the lee side ear.

location of sounds below 1000hz. Direction finding at higher frequencies is less accurate than it is for frequencies below 1000hz, until about 8000hz when the pinna (external ear) becomes effective as an aid to localization (Oster, 1973). Virtually all animal sounds are below 1000hz. It is easy to imagine why higher animals developed the ability to accurately detect the location of each others' sounds.* The relevant issue here, however, is that it is this innate ability of the brain to detect wave form phase differences which gives rise to binaural beats. When signals of two different frequencies are presented through headphones, one frequency to one ear and another frequency to the other ear, the signals do not heterodyne (as described before) nor produce a beat frequency oscillation. What does happen is the brain detects phase differences between these signals. Under natural circumstances a detected phase difference would provide directional information to the higher centers of the brain. But with headphones on -- well, with headphones on there is a totally different situation. Within the sound processing centers of the brain, pulse stimulation provides relevant information to the higher centers of the brain. In the case of a wave form phase difference the electron pulse rate in one part of a sound

*As an interesting alternative, some birds are ventriloquial. They produce bird song which conceals their true location by presenting a false sonic local through wave form phase alteration.

processing center is greater than in another. The differences in electron pulse stimulation within the sound processing centers of the brain are an anomaly. This anomaly (the difference in electron pulse stimulation) comes and goes as the two different frequency wave forms mesh in and out of phase. As a result of these constantly increasing and decreasing differences in electron pulse stimulation, an amplitude modulated standing wave (the binaural beat) is generated within the sound processing centers of the brain itself. It is this standing wave which acts to entrain brain waves - the frequency following response (FFR) of Hemisync. It is important to grasp the fact that no one ever hears binaural beats. The sound processing centers of the brain only think something is heard. Additionally, the production of an amplitude modulated standing wave is dependent on the ability of the electrochemical cellular structure of brain tissues to resonate. Brain tissues do resonate as evidenced by the manifestation of electromagnetic brain waves. These brain waves are generally confined to frequencies below about 30hz. The same is true for binaural beats. Experimental subjects do not report "hearing" binaural beats above about 30hz (Oster, 1973).

Beyond the Basics:

The term Hemisync was chosen because many of the states of consciousness available through this technology are the result of wave forms of equal amplitude and frequency in both hemispheres of the brain. The reason for this is physiological. Each ear is

"hard-wired" (so to speak) to both hemispheres of the brain (Rosenzweig, 1961). Each hemisphere has its own olivary nucleus (sound processing center) which receives signals from each ear. In keeping with this physiological structure, when a binaural beat is present there are actually two standing waves of equal amplitude and frequency present, one in each hemisphere. The two separate standing waves entrain each hemisphere to the same frequency.

The complexities of an effective Hemisync signal are amazing. Each state of consciousness is not represented by one simple brain wave. Each state of consciousness involves a milieu of inner mixing of wave forms. The reason for this lies in the structure of the brain itself. Not only is the brain divided into hemispheres, it is also divided vertically into the cerebellum, the thalamus, the limbic system, and the cerebral cortex. The cerebral cortex is further divided into such functional areas as the frontal lobes, the parietal lobes, and the occipital lobes. There are of course many other subdivisions of the brain not mentioned here. The point is that for each discrete state of consciousness each area of the brain resonates at a specific brain wave frequency because it preforms a localized function (Luria, 1970). To entrain a particular state of consciousness then, one must identify these complex wave forms and mimic them through the use of binaural beats, multiplexed carrier signals, and heterodyned binaural beats. This is the Hemisync process.

The Monroe Institute has been identifying these states of consciousness and developing Hemisync signals for almost two decades. The process of developing effective Hemisync signals has been as complex as the function of the brain itself. Under laboratory conditions many subjects were tested for their responses to binaural beats. Records were kept as to the effect each binaural beat frequency had on these subjects. Then binaural beats were mixed and records were again kept on the subjects' responses. After many months (in some cases, years), test results began to show population-wide similar responses to specific mixes of binaural beats, which laid the foundation for what is now called Hemisync (Monroe, 1982). The individual binaural beats within these unique mixes entrained separate areas of the brain to different frequencies, effectively producing discrete states of consciousness. In the case of the state of consciousness coined Focus 10 (mind awake, body asleep) for example, the cerebellum, which works below the level of consciousness and deals with muscles and body functions, must be entrained to a delta frequency. Under these conditions (a delta brain wave within the cerebellum) the body is asleep. The "mind awake" half of Focus 10 is achieved by entraining the cerebral cortex to a low beta frequency. The subject's exposure to these individual binaural beats is timed, introducing the delta cerebellum signal first and later mixing in the low beta cerebral cortex signal. The mixing of these two binaural beats produces a complex Hemisync signal. This Focus 10 Hemisync signal also

seems to have a soothing entrainment effect on the limbic system (brain's emotional center) as evidenced by the many subjects who report that Focus 10 is a very pleasant experience. A subject is said to have achieved Focus 10 when a new condition of homeostasis is established (evidenced by appropriate brain wave patterns) and the subject becomes unaware of the location of body parts (hands, feet, etc.), still without losing consciousness (falling asleep).

The Hemisync process is available outside the laboratory through the use of prerecorded stereo cassette tapes and a Hemisync synthesizer (Monroe, 1985). These tapes and the synthesizer offer many Hemisync environments sometimes involving the use of as many as six individual binaural beat frequencies. Through the use of Hemisync audio tapes and the synthesizer one can explore different states of consciousness, determine their benefit, and learn to attain these states at will - without the use of equipment.

The Cross Callosal Mediation Benefits of Hemisync:

Hemisync is but one tool which is effective for the attainment of desired states of consciousness. The disciplines of psychodrama, Assagioli's psychosynthesis, yoga, and others are all effective in breaking down the homeostasis of dysfunctional states of consciousness and the establishment of new perspectives of reality. Hemisync is unique in its contribution to brain function. Hemisync can actually enhance the effectiveness of the

brain by enabling the user to mediate cross callosal connectivity at designated brain wave frequencies.

The two cerebral hemispheres of the brain are like two separate information processing modules. Both are complex cognitive systems, both process information independently and in parallel and their interaction is neither arbitrary nor continuous (Zaidel, 1985). Because of this, states of consciousness can be defined not only in terms of brain wave frequency but also in terms of hemispheric specialization and/or interaction. Some desired states of consciousness may require facile inter-hemispheric integration, while others may call for a unique hemispheric processing style (Zaidel, 1986). One's cognitive repertoire and therefore his ability to perceive reality and deal with the everyday world is subject to his ability to control his states of consciousness (including the mediation of interhemispheric processing). As stated before, states of consciousness are subject to change in response to immediate socio-environmental surroundings as well as drugs and sunspots. Hemispheric dominance in particular has an ultradian periodicity (Rossi, 1986). Individuals can, however, learn to control hemispheric dominance through the disciplines of biofeedback, yogic breathing, and others (Budzynski, 1986). But Hemisync is the only method of learning to control <u>both</u> hemispheric specialization and/or interaction and brain wave frequencies. The result of such control is the maximizing of the effectiveness of the human brain, or, put another way, the

effective employment of appropriate states of consciousness to state specific environments or situations.

Hemisync binaural beats can be generated to either facilitate interhemispheric integration or facilitate left/right hemispheric dominance. If a state of consciousness is desired which requires interhemispheric processing, then conventional Hemisync binaural beats are used. As explained previously, a conventional binaural beat generates two amplitude modulated standing waves, one in each hemisphere's olivary nucleus. Such binaural beats will entrain both hemispheres to the same frequency establishing equivalent electromagnetic environments and maximizing interhemispheric neural communication (Edrington and Panagiotides, 1984). The process is much like tuning (impedance matching) oscillators. When two oscillators are tuned to the same frequency information and energy pass freely between them. With conventional Hemisync binaural beats the standing waves are in phase and synchronous in both hemispheres (hence the name Hemisync) and information passes freely between them. Specific states of consciousness which are attainable with conventional Hemisync binaural beats include those states which require cross callosal interhemispheric processing. The following operant behaviors are suggested as requiring such states of consciousness:

Learning Tasks (such as)

Foreign language

Music

Morse code

Therapeutics (such as)

Dyslexia

Retardation

Stroke

Performance Tasks (such as)

Sports

Chess (and other similar board games)

Creative problem solving

Computer programing

Remote viewing

If a state of consciousness is desired which requires hemispheric specialization or dominance or hemispheric entrainment to different brain waves, then unconventional Hemisync binaural beats are used. An unconventional Hemisync binaural beat is one in which the amplitude modulated standing wave in one (selected) hemisphere is attenuated. This is possible, fortunately, by virtue of the physiology of the brain. The acoustic nerve fibers form each ear are unequally divided between the hemispheres. From each ear more nerve fibers (more pulse stimulation) go to the opposing hemisphere than to the local hemisphere (Luria, 1970). To attenuate a binaural beat standing wave in the left hemisphere one must reduce the volume of the Hemisync signal in the right ear. The converse is, of course, also true. The reason this will reduce the standing wave in the opposing hemisphere is because there are more nerve fibers

leading to the opposing hemisphere and the reduction in volume (less pulse stimulation) will have more effect there. Through the application of this same principle, Hemisync entrainment amplitude modulated standing waves of different frequencies can be established in the different hemispheres. Specific states of consciousness which are attainable with unconventional Hemisync binaural beats include those states which require hemispheric specialization or dominance. The following operant behaviors are suggested as requiring such states of consciousness:

Learning Tasks (such as)

Elementary math (LH)

Grammar (LH)

Art (RH)

Performance Tasks (such as)

Accounting (LH)

Listening to music (RH)

Conclusion:

An extensive evaluation of Hemisync has shown that Hemisync provides a highly selective entrainment vehicle within the brain itself. The selectivity of this vehicle can provide the user with a variety of states of consciousness and the fact that the vehicle operates within the brain itself insures its effectiveness.

The Monroe Institute can be contacted by writing to TMI, Route 1, Box 175, Faber, VA 22938 or telephone (804) 361-1252.

REFERENCES

Assagioli, R. Psychosynthesis. New York: Penguin Books, 1984

Budzynski, T. H. Clinical Applications of Non-Drug-Induced States. Handbook of States of Consciousness. B. Wolman and M. Ullman (Eds.). New York: Van Nostrand Reinhold, 1986.

Edrington, D. and Panagiotides, H. (1984). [EEG Response to Auditory Stimuli]. Unpublished raw data.

Green, E. E. and Green, A. M. Biofeedback and States of Consciousness. Handbook of States of Consciousness. B. Wolman and M. Ullman (Eds.). New York: Van Nostrand Reinhold, 1986.

Houck, G. B. Entrainment Techniques. Unpublished research, McDonnell Douglas Astronautics Company, Huntington Beach, CA, 1984.

Luria, A. R. The Functional Organization of the Brain. Recent Progress in Perception. San Francisco: W. H. Freeman and Company, 1970.

Monroe, R. A. The Hemisync Process. Monroe Institute Bulletin, Nellysford, VA, 1982, #PR31380H.

Monroe, R. A. Hemisync Synthesizer. Breakthrough. Faber, VA: Monroe Institute of Applied Sciences, 1985.

Oster, G. Auditory Beats in the Brain. Scientific American, 1973, (4)229, 94-102.

Rosenzweig, M. R. Auditory Localization. Perception: Mechanisms and Models. San Francisco: W. H. Freeman and Company, 1961.

Rossi, E. L. Altered States of Consciousness in Everyday Life: The Ultradian Rhythms. Handbook of States of Consciousness. B. Wolman and M. Ullman (Eds.). New York: Van Nostrand Reinhold, 1986.

Tart, C. T. States of Consciousness. New York: E. P. Dutton & Co., Inc., 1975, 31, 72-73.

Zaidel, E. Academic Implications of Dual-Brain Theory. The Dual Brain. New York: The Guilford Press, 1985.

Zaidel, E. Callosal Dynamics and Right Hemisphere Language. Two Hemispheres - One Brain: Functions of the Corpus Callosum, 1986, 435-459.